FUSULINA CYLINDRICA SHELL STRUCTURE.

BY ALVA J. SMITH, EMPORIA.

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The living Fusulina cylindrica was a member of the animal sub-kingdom Protozoa, class Rhizopoda, order Foraminifera, family Nummulitidae.

The shape of the shell of the young is a spheroid, but changes during the growth of the animal to an ovaloid, which resembles a grain of wheat in both form and size. The shell is composed of longitudinal chambers arranged spirally around a central spherical chamber, making about ten complete whorls in the adult shell.

The average length of the Fusulina is about 6 mm. and the thickness 2.5 mm. The spheroidal nucleus or central chamber is about 1-10 mm. in diameter and is provided with many circular openings, through which the animal protrudes its thread-like pseudopodia, and is connected by a small open entrance to the second chamber.

The second chamber is about 3-100 mm. in width, while its length embraces slightly over one-half of the nucleal chamber. Each succeeding chamber extends a little beyond its predecessor. This lapping of the chambers at the ends causes the increase in the longitudinal dimensions of the shell as it grows by the addition of chamber after chamber.

The size of the chambers and the thickness and strength of their walls increase from the center out. An open passage bearing a resemblance to the siphuncle in cephalopods lies as a trough along the ventral side of the chambers and cuts away the lower half of the septa where it passes through them.

The name "involute sinus" has been proposed by Professor Williston for this trough-like passage. The width of the openings in the septa increases from about $\frac{1}{25}$ mm. at the nucleus to 1 mm. in the outer whorls. The septa are also punctured by many minute circular openings (foramina) which were once occupied by the pseudopodia of the animal, and later served as ways for the protoplasm of the animal to communicate from chamber to chamber.

The outer walls of the chambers possess very few if any foramina or other openings. They are slightly more convex than the general curve of the whorl, and extend in graceful double curves from the girdle to either end, giving a corrugated appearance to the outer surface of the shell. The living Fusulina was evidently one composite body, occupying all the chambers of the entire shell at the same time, with a common vitality; a continual circulation of protoplasm taking place from chamber to chamber through the minute foramina and the siphuncle-like openings in the septa.

The first chamber occupied by the young Fusulina is nearly spherical. A spherical first chamber is found in a great number of Foraminifera whose later forms bear no resemblance to a sphere, the form of the succeeding chambers and the final shape of the adult shell depending upon the order in which the multiplication of chambers takes place and their manner of attachment to the parent mass.

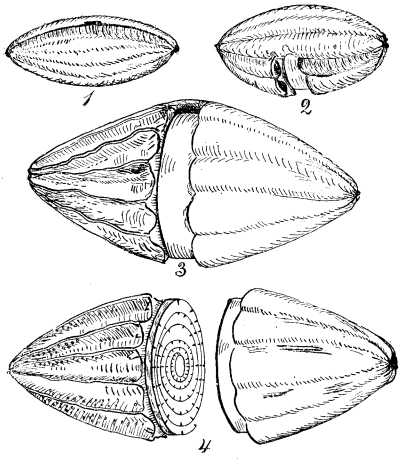
In the Fusulina the animal occupied the central spherical shell for a time; then a portion of its ameboid contents spread out through an opening in the shell, forming a belt about $\frac{3}{100}$ mm. wide on the outside, its length embracing slightly over one-half the perimeter of the shell.

This strip of living matter soon secreted a calcareous covering, which is the second chamber of the shell. The third chamber is formed by a similar process

along the sides of the one already formed. A continual repetition of this process completes the shell as we now find it fossilized in our limestone.

As I have taken issue in this paper with some eminent naturalists regarding the compound life of a rhizopod, it is right that I should give reasons for so doing.

Dana says "the cells of rhizopods are each occupied by a separate animal." While it is possible for this to be the case with some species of rhizopods, it is impossible with the Fusulina, for an independent animal occupying the central cells would have access to neither food nor oxygen, after being enclosed by the outer portions of the shell. The possession of the trough-like siphuncle indicates the flowing of matter from chamber to chamber along this course, as also do the thickened ends and rounded corners of the septa where cut by this trough. We know that an irritation of the bodies of conchiferous animals produces an increase in the calcareous secretions at tne point irritated. Then the increased thickness and rounded corners of the septa where cut by the stolon passage may point to an irritation of the Fusulina at these points, which could only come by a flowing of the protoplasm through the involute sinus. Only by a system of circulation through the openings in the septa can an ameboid animal secure the essential food and oxygen to maintain life while inhabiting the recesses of a chambered shell like the Fusulina cylindrica.



EXPLANATION OF FIGURES.

Figure 1, in the accompanying plate, represents Fusulina cylindrica magnified six diameters.

Figure 2 represents the same with a small portion of the outer surface broken away, exposing a portion of the involute sinus and the openings in the exposed ends of the chambers.

Figure 3 shows a Fusulina magnified twelve diameters, with the outer walls of the chambers removed from one-half of the shell.

Figure 4 is the same cut in half, showing a diagram of the internal coils and the central chamber.

NEW DEVELOPMENTS IN THE MENTOR BEDS.

BY A. W. JONES, SALINA.

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Since the last meeting of the Academy of Science I have found the Mentor in several more localities in Saline county, and have collected quite a number of fossils, a series of which I have submitted to Prof. T. W. Stanton, of the United States Geological Survey, for determination, and as a result fourteen species have been added to the list previously given by Professors Cragin and Mudge, making the number of species from the Mentor now thirty-nine, and I think I still have two or three undetermined species on hand. Of this number nine appear to be